

47. The X-ray exposure apparatus of claim 1, further comprising means altering a peak wavelength of said light emanating from said X-ray mirror while maintaining an optical axis of said light emanating from said X-ray mirror.

48. The X-ray exposure method of claim 24, further comprising the step of altering a peak wavelength of said X-ray emanating from said X-ray mirror while maintaining a direction of said X-ray emanating from said X-ray mirror.

49. The X-ray exposure method of claim 24, further comprising the step of altering a peak wavelength of said X-ray emanating from said X-ray mirror while maintaining an optical axis of said X-ray emanating from said X-ray mirror.--

REMARKS

Claims 1, 16, 24, 40, 42 and 44 are the sole independent claims. Claims 1, 16, 24, 40 and 42 stand rejected under 35 U.S.C. § 103 over Hasegawa et al. ('400) in view of Cash ('588); and claim 44 stands rejected under 35 U.S.C. § 103 over Hasagawa et al. in view of Cash, Imai et al. ('091), and Waldo ('958). In order to expedite prosecution, claims 1, 16, 24, 40 and 42 have been amended to clarify the distinction between the present invention and the cited prior art. This rejection is respectfully traversed for the following reasons.

A. CLAIMS 1, 24, 40 AND 42

Each of claims 1, 24, 40 and 42 have been amended to define an X ray used to provide exposure having a component in wavelength of 0.45 nm to 0.7 nm. It is respectfully submitted that the cited prior art does not disclose or suggest, *inter alia*, the aforementioned limitation as now recited in claims 1, 24, 40 and 42.

The Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, it is submitted that the cited prior art does not disclose or suggest, *inter alia*, an X ray used to provide exposure having a component in wavelength of 0.45 nm to 0.7 nm, as recited in independent claims 1, 24, 40 and 42. Accordingly, as the proposed combination fails the "all the claim limitations" standard required under 35 U.S.C. § 103, it is respectfully submitted that the proposed combination does not establish *prima facie* obviousness of claims 1, 24, 40 and 42.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1, 24, 40 and 42 are patentable for the reasons set forth above, it is respectfully submitted that dependent claims 2-15, 25-39 and 41 which depend on claims 1, 24 and 40, respectively, are also patentable.

B. CLAIM 16

Claim 16 has been amended to define an "X-ray mirror containing one type of material for mirror selected from the group consisting of titanium, silver, ruthenium, palladium, and nitride thereof, a carbide thereof, a boride thereof, diamond, diamond-like carbon, and boron nitride." None of the cited prior art disclose or suggest the aforementioned materials for the X-ray mirror (e.g., Cash, Jr. and Howells disclose beryllium and rhodium). Again, the proposed combination fails the "all the claim limitations" standard required under 35 U.S.C. § 103 discussed above. It is therefore submitted that the proposed combination does not establish *prima facie* obviousness of claim 16. Furthermore, the cited prior art also does not disclose or suggest that an X ray of a range of a short wavelength (of 0.45 nm to 0.7 nm) is used to provide exposure, as disclosed in the present invention.

Again, with reference to the previously cited Federal Circuit guidelines and because claim 16 is patentable for the reasons set forth above, it is respectfully submitted that dependent claims 17-23 which depend on claim 16 are also patentable.

C. CLAIM 44

Imai discloses an invention pertinent to an X-ray window which will be mounted on an X-ray introducing opening of X-ray detectors, whereas the present invention is directed to X-ray lithography. Accordingly, it is submitted that the pertinent fields of art of the present invention and Imai et al. are different and non-analogous. Moreover, Waldo discloses an X-ray exposure apparatus including filter 18, exposure chamber 20 and other components. Although the exposure chamber has X-ray mask 22 arranged therein, Waldo fails to describe any specific structure of the mask.

The Examiner applies a material for filter 18 of Waldo (see fig. 1 of Waldo) to that of crosspieces 2 of an X-ray window of Imai et al. (see fig. 2 of Imai et al.). However, Waldo's filter 18 is used to change the distribution of the energy of an X-ray illuminating and X-ray mask. It is therefore submitted that filter 18 of Waldo and crosspieces 2 of the X-ray window of Imai are directed to different aims and have different functions, and are thereby non-analogous. Accordingly, the material for filter 18 of Waldo is not applicable to the crosspieces 2 of the X-ray window of Imai et al., and nothing in the prior art suggests otherwise.

It is respectfully submitted that the proposed combination is based solely on improper hindsight reasoning, whereby the Examiner selected bits and pieces of the claimed invention from plural references and used only Applicants' specification as a guide to reconstruct the claimed invention. Therefore, the proposed combination fails to establish *prima facie* obviousness of claim 44 and its dependent claim 45.

As is well known in patent law, a *prima facie* showing of obviousness can only be established if the prior art "suggests the desirability" of the proposed combination using *objective* evidence. The Examiner is directed to MPEP § 2143.01 under the subsection entitled "Fact that References Can Be Combined or Modified is Not Sufficient to Establish *Prima Facie* Obviousness", which sets forth the applicable standard:

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. (*In re Mills*, 16 USPQ2d 1430 (Fed. Cir. 1990)).

In the instant case, the Examiner merely alleges "the use of masks with those material characteristics *can* be employed in any type of x-ray apparatus using masks as

shown by Imai et al. and Waldo" (emphasis added). As noted above, the cited prior art is non-analogous for the reasons discussed above.

Nevertheless, it is submitted that the "mere fact that [Hasegawa et al., Cash, Imai et al., and Waldo] *can* be combined ... does not render the resultant combination obvious" because nowhere does the *prior art* "suggest the desirability" of the proposed combination. Accordingly, even assuming all allegations made by the Examiner with respect to the content of the prior art are proper, it is submitted that, at best, the Examiner has shown that bits and pieces of the claimed invention are *individually* known. However, a proper rejection under 35 U.S.C. § 103 must show that the *combination* of elements recited in the claims would have been obvious based on *objective* evidence *from the prior art*.

The Examiner is directed to MPEP § 2143.01 under the subsection entitled "Fact that the Claimed Invention is Within the Capabilities of One of Ordinary Skill in the Art is Not Sufficient by Itself to Establish *Prima Facie* Obviousness", which sets forth the applicable standard:

A statement that modifications of the prior art to meet the claimed invention would have been [obvious] because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. (citing *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993)).

In the instant case, even assuming *arguendo* that there was prior art that "teach that all aspects of the claimed invention [are] individually known in the art", it is submitted that such a conclusion "is not sufficient to establish a *prima facie* case of obviousness" because there is no *objective* reason from the *prior art* on the record to

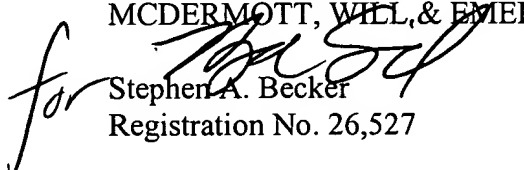
combine Hasegawa et al. with all of Cash, Imai et al., and Waldo in the manner set forth by the Examiner.

Based on all the foregoing, it is respectfully submitted that claims 1-45 are patentable over the cited prior art. Accordingly, it is respectfully requested that the pending rejections under 35 U.S.C. § 103 of claims 1-45, be withdrawn. New dependent claims 46-49 add further novel features of the present invention and are submitted to be allowable based on their own merits, in addition to being dependent on novel independent claims. Support for the new claims can be found in Applicants' specification with respect to the 10th-13th embodiments and related Figures.

CONCLUSION

Having fully and completely responded to the Office Action, Applicants submit that all of the claims are now in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below. To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,
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APPENDIX

IN THE CLAIMS

Claims 1, 16, 24, 40 and 42 have been amended as follows:

1. (Amended) An X-ray exposure apparatus comprising an X-ray mirror containing a material having an absorption edge only in [at least either one of] a wavelength region [of less] other than 0.45 nm [and a wavelength region exceeding 0.7 nm as to X-rays] through 0.7 nm as to X-rays to utilize light at least having a component in wavelength ranging from 0.45 nm through 0.7 nm.

16. (Amended) An X-ray mirror [having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays] containing one type of material for mirror selected from the group consisting of titanium, silver, ruthenium, palladium, and nitride thereof, a carbide thereof, a boride thereof, diamond, diamond-like carbon, and boron nitride.

24. (Amended) An X-ray exposure method comprising:
an X-ray incidence step of making X-rays incident upon an X-ray mirror containing a material having an absorption edge only in [at least either one of] a wavelength region [of less] other than 0.45 nm [and a wavelength region exceeding] through 0.7 nm as to X-rays; and
an exposure step of performing exposure with X-rays outgoing from said X-ray mirror and at least having a component in wavelength ranging from 0.45 nm through 0.7 nm.

40. (Amended) A synchrotron radiation apparatus comprising a synchrotron radiation source and an X-ray mirror group including a plurality of X-ray mirrors upon which radiation outgoing from said synchrotron radiation source is incident, wherein

said X-ray mirrors contain a material having an absorption edge only in [at least either one of] a wavelength region [of less] other than 0.45 nm [and a wavelength region exceeding] through 0.7 nm as to X-rays, [and]

the outgoing direction of said radiation outgoing from said synchrotron radiation source and the outgoing direction of reflected light outgoing from said X-ray mirror group are substantially identical, and

said X-ray mirror is used to utilize light at least having a component in wavelength ranging from 0.45nm through 0.7 nm.

42. (Amended) A synchrotron radiation method employing a synchrotron radiation apparatus comprising a synchrotron radiation source and an X-ray mirror group including a plurality of X-ray mirrors upon which radiation outgoing from said synchrotron radiation source is incident, said synchrotron radiation method comprising:

a radiation incidence step of making radiation outgoing from the synchrotron radiation source incident upon an X-ray mirror containing a material having an absorption edge only in [at least either one of] a wavelength region [of less] other than 0.45 nm [and a wavelength region exceeding] through 0.7 nm as to X-rays, and

a reflected light emitting step of emitting reflected light from said X-ray mirror group in a direction substantially identical to the outgoing direction of the radiation

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outgoing from said synchrotron radiation source, said reflected light at least having a component in wavelength ranging from 0.45 nm through 0.7 nm.